

## BLOWER CONTROL SYSTEM

### DESCRIPTION

#### RELATED APPLICATION

**[Para 1]** This application is a continuation-in-part of co-pending application Serial Number 10/216,152 filed 08/09/2002.

#### BACKGROUND OF THE INVENTION

**[Para 2]** 1. Field of the Invention

**[Para 3]** The subject invention relates to an assembly for blowing liquids from the surface of a vehicle in a car wash.

**[Para 4]** 2. Description of the Prior Art

**[Para 5]** Assemblies for blowing liquids from a vehicle typically include a support plenum for distributing air and a nozzle system including a nozzle for directing air toward the top of a vehicle. Examples of such assemblies are disclosed in U.S. Patents 5,421,102; 5,901,461 and 5,960,564, all in the name of McElroy et al and assigned to the assignee of the subject invention.

**[Para 6]** Many assemblies include an air delivery conduit interconnecting the plenum and the nozzle system for delivering air from the plenum to the nozzle system while allowing the nozzle system to move in an adjustment direction toward and away from the plenum between various vertical-operating positions. Examples of such systems are disclosed in U.S. Patents 2,440,157 to Rousseau and 3,765,104 to Takeuchi. Yet other assemblies rotate the nozzle to different directions as the vehicle moves therewith. Examples of such assemblies are disclosed in U.S. Patents 3,279,093 to Dutton; 4,730,401 to Machin; 5,367,739 and 6,000,095 to Johnson; 5,596,818 to Jones; and 5,749,161 to Jones.

**[Para 7]** The earlier filed patent application referred to above, broadly discloses a control system for controlling the movement of the nozzle but there remains a need for a more multifaceted control system.

#### SUMMARY OF THE INVENTION AND ADVANTAGES

**[Para 8]** The subject invention fills this need and provides an assembly having both features.

**[Para 9]** The invention provides an assembly for blowing liquids from a vehicle comprising a support plenum for distributing air, a nozzle system including a nozzle for directing air toward the top of a vehicle, and an air delivery conduit interconnecting the plenum and the nozzle system for delivering air from the plenum to the nozzle system while allowing the nozzle system to move in an adjustment direction toward and away from the plenum between various vertical operating positions. A first sensor is disposed upstream of the nozzle for detecting the presence of a vehicle from above and for generating a blower start signal and for generating an actuator signal to energize the actuator and move the nozzle system vertically between the operating positions. A second sensor is disposed between the first sensor and the nozzle for detecting the contour of a vehicle from above. A third sensor is disposed downstream of the second sensor for sensing the rear of a vehicle from above. A controller is responsive to the sensors for processing a rotary signal to energize the rotary drive for rotating the nozzle about a nozzle axis and for processing the blower start signal and the actuator signal

**[Para 10]** Accordingly, the assembly includes a nozzle system that may be moved up and down to accommodate the changing longitudinal configuration of a vehicle and the nozzle may be rotated about the nozzle axis to efficiently direct air against the contour of the vehicle with a plurality of sensors that sense the presence of a vehicle and a controller to control the various operations of the system as the vehicle moves beneath the nozzle.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[Para 11]** Other advantages of the present invention will be readily appreciated, as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

**[Para 12]** Figure 1 is a frontal view of the subject invention;

**[Para 13]** Figure 2 is a top view of the subject invention;

**[Para 14]** Figure 3 is a frontal view similar to Figure 1 but showing only the nozzle of the invention in the retracted position;

**[Para 15]** Figure 4 is a frontal view like Figure 3 but showing the nozzle of the invention in the extended position;

**[Para 16]** Figure 5 is a side elevational view showing the nozzle of the invention relative to vehicles and relative to sensors for controlling the operational position of the nozzle; and

**[Para 17]** Figure 6 is block diagram of the control system use to control the movement of the subject invention.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

**[Para 18]** Referring to the Figures, wherein like numerals indicate like or corresponding parts throughout the several views, an assembly for blowing liquids from a vehicle is generally shown at **10**.

**[Para 19]** The assembly comprises a support plenum **12** for distributing air. A nozzle system is generally indicated at **14** and includes a nozzle **16** for directing air toward the top of a vehicle **18**. The nozzle **16** comprises a flexible material, such as a fabric as is well known in the art. In addition, the assembly includes side nozzles systems, generally shown at **17** for directing air from the side legs of the plenum **12**, as is well known and shown in the aforementioned U.S. patent 5,960,564.

**[Para 20]** An air delivery conduit, including a plurality of pairs of telescoping tubes **20** and **22**, interconnects the plenum **12** and the nozzle system **14** for delivering air from the plenum **12** to the nozzle system **14** while allowing the nozzle system **14** to move in an adjustment direction toward and away from the plenum **12** between various vertical operating positions, as illustrated by comparing Figures 1 and 3. The telescoping tubes **20** and **22** include a base tube **20** extending from the support plenum **12** and a movable tube **22** in telescoping relationship with the base tube **20** and attached to the nozzle system **14**. The tubes **20** and **22** are rigid and self-supporting and may be made of various materials such as metal or plastic. The tubes **20** and **22** are circular in cross section, as shown in phantom in Figure 2, and have a close or airtight fit. There may be a sliding seal incorporated between the tubes **20** and **22** to effect an air tight seal to prevent the leakage of air as the movable tubes **22** are moved into and out of the fixed or base tubes **20**. The base tubes **20** are welded or otherwise fastened to the support plenum **12**.

**[Para 21]** The nozzle system **14** is elongated and includes a fixed outer and upper shell **24** and a movable lower or inner shell **26** movably supported by the fixed shell **24**. The movable tubes **22** are attached to the fixed shell **24** by welding or fasteners. The inner or movable shell **26** is rotatably supported within the fixed shell **24** as the fixed shell **24** has an elongated opening along the bottom for the passage of air into the nozzle **16** and the movable shell **26** has an elongated opening along the top to accommodate the rotational movement of the movable shell **26** about a nozzle axis which is at the center of the circular shells **24** and **26**.

**[Para 22]** The nozzle system **14** is suspended by bungee chords **32** which are attached to a cross bar **34**, the cross bar **34** supporting the fixed shell **24**. The bungee chords **32** extend upwardly to an upper end **38** secured to the plenum **12** and

act as a spring **40** to react between that upper end **38** and the cross bar **34** to lift the nozzle system **14** in the event of loss of power, or the like.

**[Para 23]** An actuator in the form of a pneumatic cylinder **42** is included for moving the nozzle system **14** between the operating positions whereby the nozzle system **14** may be moved up and down to accommodate the changing longitudinal configuration of a vehicle **18**. The piston of the pneumatic cylinder **42** is attached to the cross bar **34** to move the nozzle system **14** up and down between raised and lowered operating positions. The bungee chords **32** act as a biasing system for automatically retracting the nozzle system **14** toward the raised operating position in response to loss of control by the actuator **42**.

**[Para 24]** The assembly also includes a rotary drive in the form of a solenoid **46** for rotating the nozzle **16** about the nozzle axis extending transversely to the adjustment direction and the nozzle **16** whereby the nozzle system **14** may be rotated about the nozzle axis to efficiently direct air against the contour of the vehicle **18**. The rotary drive **46** includes a solenoid to oscillate the outer or movable shell back and forth about the nozzle axis fifteen degrees in either direction from neutral, i.e., straight down.

**[Para 25]** As illustrated in Figure 5, the assembly **10** is characterized by a first sensor **50** disposed upstream of the nozzle **16** for detecting the presence of a vehicle **18** and a second sensor **52** disposed between the first sensor **50** and the nozzle **16** for detecting the contour of a vehicle **18**. As shown in Figure 6, a controller **54** is included for generating a blower start signal in response to the first sensor **50** and for generating an actuator signal to energize the actuator **42** and move the nozzle system **14** between the raised and lowered operating positions. The nozzle system **14** is raised and lowered between the various operating positions and the nozzle **16** is rotated about the nozzle axis extending transversely to the adjustment direction whereby the nozzle system **14** may be moved up and down to accommodate the changing longitudinal configuration of the vehicle **18** and the nozzle **16** may be rotated about the nozzle axis to efficiently direct air against the contour of the vehicle **18**.

**[Para 26]** A third sensor **56** is disposed adjacent the nozzle **16** to sense the front and rear of a vehicle **18**, the controller **54** being responsive to the third sensor **56** for generating a rotary signal to energize the a rotary drive **46** for rotating said nozzle **16** about a nozzle axis.

**[Para 27]** All of the sensors are ultra-sonic and are disposed above the vehicle for continuously sensing or reading the contour or profile of the vehicle from above. As set forth above, the first sensor **50** detects an entering vehicle and the third sensor **56** detects the absence or exit of a vehicle. The third sensor **56** can be positioned downstream of the nozzle **16** and at the same horizontal level or height as the first **50**.

and second **52** sensors. In other words, all three sensors **50**, **52**, **56** are at the same height above the vehicle, as shown in phantom in Figure 5.

**[Para 28]** The controller **54** includes a processor **70** for providing a second blower start-up signal in response to said second sensor **52**, i.e., a backup signal. In addition, the controller **54** includes a processor **70** for providing a rotary signal in response to the second sensor **52** to energize the rotary drive **46** for rotating the nozzle **16** about a nozzle axis in response to sensing the end of a roof of a vehicle. The second sensor **52** also controls the rotation of the nozzle **16** by the rotary drive **46** toward the front of the vehicle as well as rotation back toward the rear of the vehicle as the rear of the roof passes the second sensor **52**.

**[Para 29]** The processor **70** also processes the actuator signal to energize the actuator **42** and move the nozzle system **14** vertically down in response to the first sensor **50** sensing a vehicle and processes a second actuator signal to energize the actuator **42** and move the nozzle system **14** vertically up in response to the second sensor **52** sensing a high contour vehicle and/or move the nozzle system **14** vertically down in response to the second sensor **52** sensing the rear end of the roof of the vehicle, but only after a predetermined time delay sufficient for the rear end of the vehicle to reach the nozzle system **14**. In other words, the second sensor **52** senses the rear of the roof of the vehicle and after a time delay, which depends upon the conveyor speed moving the vehicle, the nozzle **16** is moved vertically downward toward the trunk of the vehicle or the bumper in the case of a van. The third sensor **56** also provides a duplicate actuator signal by sensing the roof, i.e., verifies that a roof is beneath the third sensor and the processor **70** processes the duplicate actuator signal to make sure to energize the actuator **42** and move the nozzle system **14** vertically down in response to the third sensor **56**. The most effective drying of the vehicle is attained by moving the nozzle **16** vertically to follow the contour of the vehicle as sensed by the three sensors **50**, **52**, **56**.

**[Para 30]** The controller **54** includes a timer circuit **58** for timing the operational time for the blower in response to the blower start signal. As the vertical actuator **42** is driven through a vertical coil driver **60** and the rotary drive **46** is driven through a rotary driver **62**, the blower motor **64** is driven through a blower motor driver **66**. The controller **54** includes a processor **70** for adjusting the operational time of the blower motor **64** in response to the number of vehicles **18** per predetermined time period to optimize the number of blower starts per hour. In other words, instead of starting and stopping the blower motor **64** between vehicles **18** in the event the vehicles **18** are far enough apart, the processor **70** will determine the average frequency of the vehicles and determine how often or at what time periods the blower motor **64** will be turned on and off to optimize the number of motor **64** starts, i.e., minimize the number of motor **64** starts.

**[Para 31]** A feedback circuit **72** is included for signaling the controller **54** in response to the nozzle system **14** reaching the lowered operating position. In the event the

nozzle system **14** does not reach the lowered position, an alarm will be triggered. The feedback **72** maybe an electrical circuit or may be implemented into the software that is responsible for the position of the nozzle system **14**. Because the third sensor **56** moves with the nozzle system **14**, the controller **54** has real time information for the position of the nozzle system **14**. Normally, the nozzle system **14** is either in the upper vertical position of Figure 3 or the lowered vertical position of Figure 4.

**[Para 32]** The controller **54** is responsive to the sensors **50, 52, 56** for generating signals to start the blower and move the nozzle system **14** vertically downward in response to the first sensor **50** detecting the presence of a vehicle without the second **52** and third **56** sensors detecting a vehicle. The controller **54** generates signals to move the nozzle system **14** vertically upward in response to the second sensor **52** detecting the presence of a vehicle with a high roof, regardless of what the other sensors are sensing. The controller **54** generates signals to rotate the nozzle system **14** toward the front of the vehicle in response to the second sensor **52** detecting the presence of a vehicle without the second sensor **52** detecting a vehicle roof. The controller **54** generates signals to move the nozzle system **14** vertically downward and to rotate the nozzle system **14** toward the rear of the vehicle in response to the second sensor **52** detecting the rear end of the vehicle roof. The controller **54** generates signals to stop the blower in response to all of the sensors **50, 52, 56** detecting the absence of a vehicle.

**[Para 33]** The controller **54** also includes a counter **74** for counting the number of vehicles passing under the nozzle system **14**. A display monitor **76** is driven through a display driver **78** for displaying information from the controller **54**, including the number of vehicles **18**. Added to this is a function switch **80** connected to the controller **54** for controlling the controller **54**. The function switch **80** may reset the system, run diagnostic functions to check the system, operate the display **76** to display the number and type of vehicles processed, e.g., cars and/or trucks or vans.

**[Para 34]** Accordingly, the invention provides a method of blowing liquids from a vehicle **18** comprising the steps of moving a vehicle along a vehicle path, positioning a nozzle **16** above the vehicle path, sensing the approach of a vehicle to the nozzle, lowering the nozzle toward the vehicle contour, blowing air through the nozzle, sensing the contour of the vehicle, rotating the nozzle toward the front of the vehicle, moving the nozzle vertically to accommodate the contour of the vehicle, rotating the nozzle in the opposite direction toward the rear of the vehicle, and timing the operational time for blowing air through the nozzle in response to sensing the approach of a vehicle for optimizing the blower on time. The number of vehicles or the rate of the vehicles is counted and the blower operational time is adjusted in response to the number of vehicles per predetermined time period to optimize the number of blower starts per hour.

**[Para 35]** Obviously, many modifications and variations of the present invention are possible in light of the above teachings. The invention may be practiced otherwise

than as specifically described within the scope of the appended claims, wherein that which is prior art is antecedent to the novelty set forth in the "characterized by" clause. The novelty is meant to be particularly and distinctly recited in the "characterized by" clause whereas the antecedent recitations merely set forth the old and well-known combination in which the invention resides. These antecedent recitations should be interpreted to cover any combination in which the inventive novelty exercises its utility. In addition, the reference numerals in the claims are merely for convenience and are not to be read in any way as limiting.